The Alan Turing Institute

Reproducible Computational Environments with Binder

Shared notes: hackmd.io/@malvikasharan/BinderJuly2020

Malvika Sharan & Sarah Gibson
Pronouns: she/her

@TuringWay @malvikasharan @mybinderteam, doi.org/10.5281/zenodo.3974919

The Alan Turing Institute

The Turing Way: A guide to reproducible, collaborative, ethical and inclusive data science

@TuringWay @malvikasharan @mybinderteam, doi.org/10.5281/zenodo.3974919

The Turing Way is an **open source book project** that involves and supports a **diverse research community** in ensuring that reproducible and ethical **data science** is accessible and comprehensible **for everyone**.

@TuringWay @malvikasharan @mybinderteam, doi.org/10.5281/zenodo.3974919

The Turing Way Team and Community

Kirstie Whitaker
Turing Research Fellow

The Turing Way is a lightly opinionated guide to reproducible data science.

Our goal is to provide all the information that researchers need at the start of their projects to ensure that they are easy to reproduce at the end.

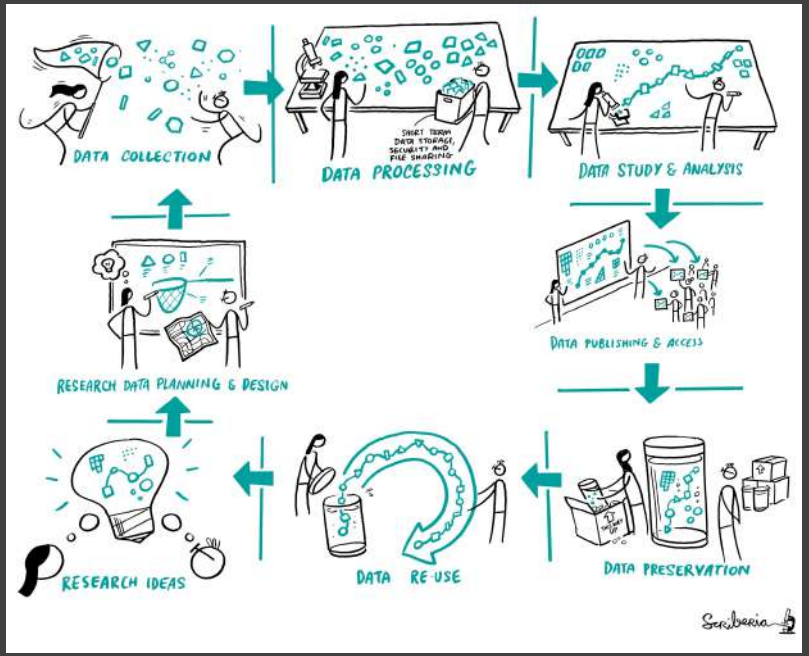
This also means making sure PhD students, postdocs, PIs, and funding teams know which parts of the "responsibility of reproducibility" they can affect, and what they should do to nudge data science to being more efficient, effective, and understandable.

Github: https://github.com/alan-turing-institute/the-turing-way, Book: https://the-turing-way.netlify.com

Started as a book on reproducibility

Same analysis steps on the same dataset produces same answer

This process is overwhelming.



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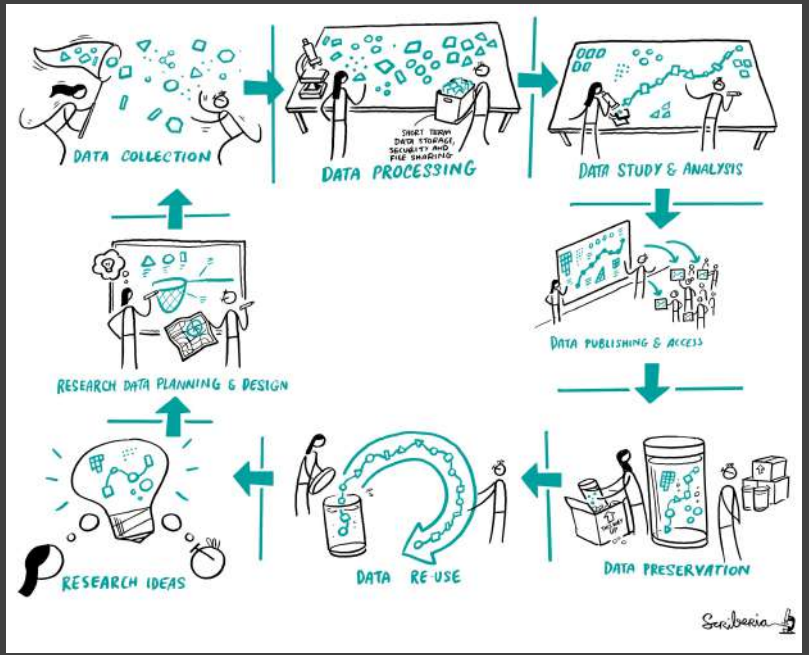
Same analysis steps on the same dataset produces same answer

This process is overwhelming.

1.5 years, >20 chapters,

>170 contributors,

a successful community



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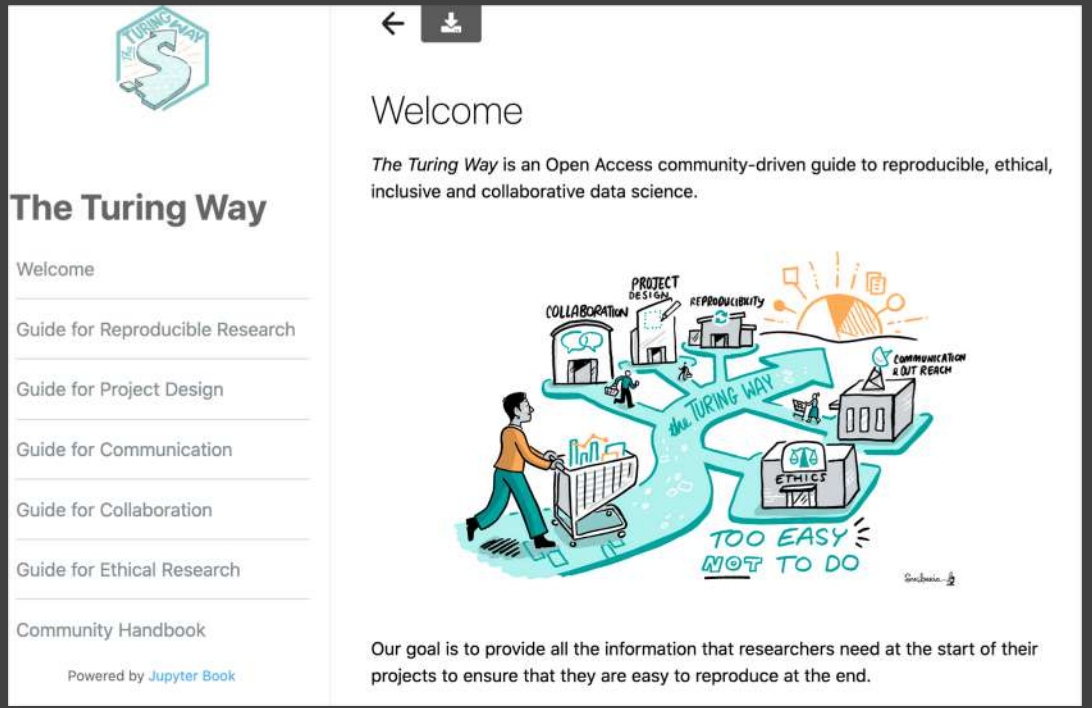
Expansion of Scope

- Reproducibility
- Project Design
- Collaboration
- Communication
- Ethics

It's about 'the journey'



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The Turing Way

Search this book...

Welcome

Guide for Reproducible Research

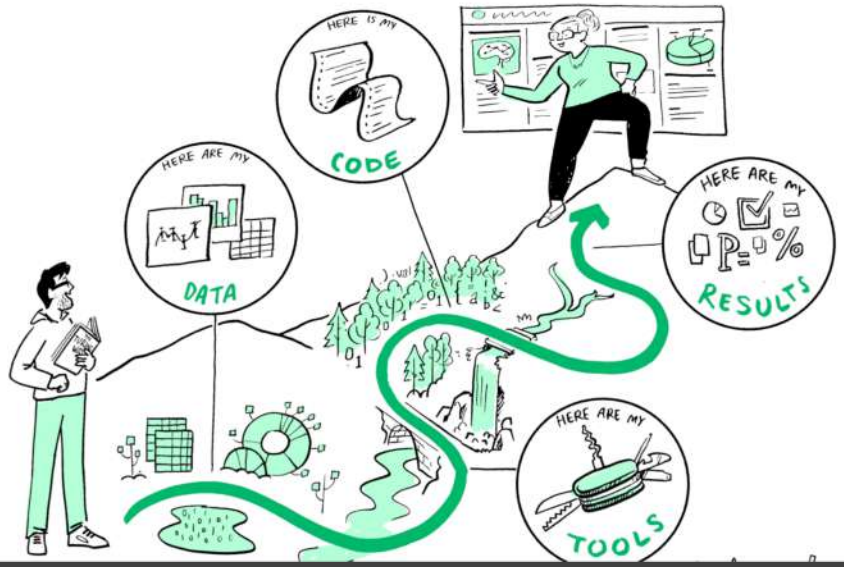
- Overview
- Open Research
- Version Control
- Licensing
- Research Data Management
- Reproducible Environments
- BinderHub
- Code quality
- Code Testing
- Code Reviewing Process
- Continuous Integration
- Reproducible Research with Make
- Research Compendia
- Credit for Reproducible Research
- Risk Assessment

Guide for Reproducible Research

This guide covers topics related to skills, tools and best practices for research reproducibility.

The Turing Way defines reproducibility in data research as data and code being available to fully rerun the analysis.

There are several definitions of reproducibility in use, and we discuss these in more detail in the Definitions of Reproducibility section of this chapter. While it it absolutely fine for us each to use different words, it will be useful for you to know how *The Turing Way* defines *reproducibility* to avoid misunderstandings when reading the rest of the handbook.



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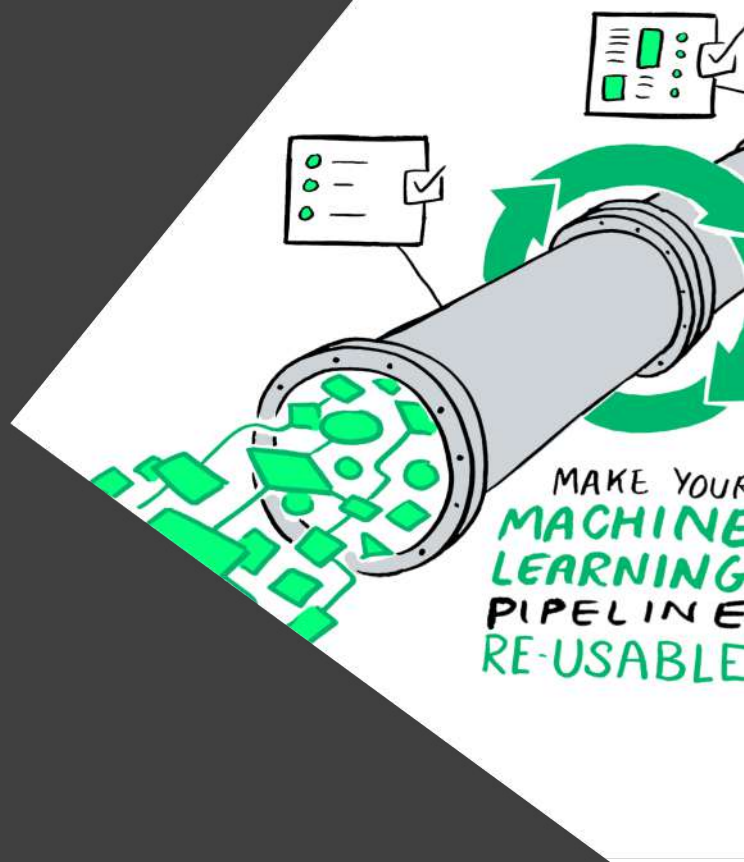
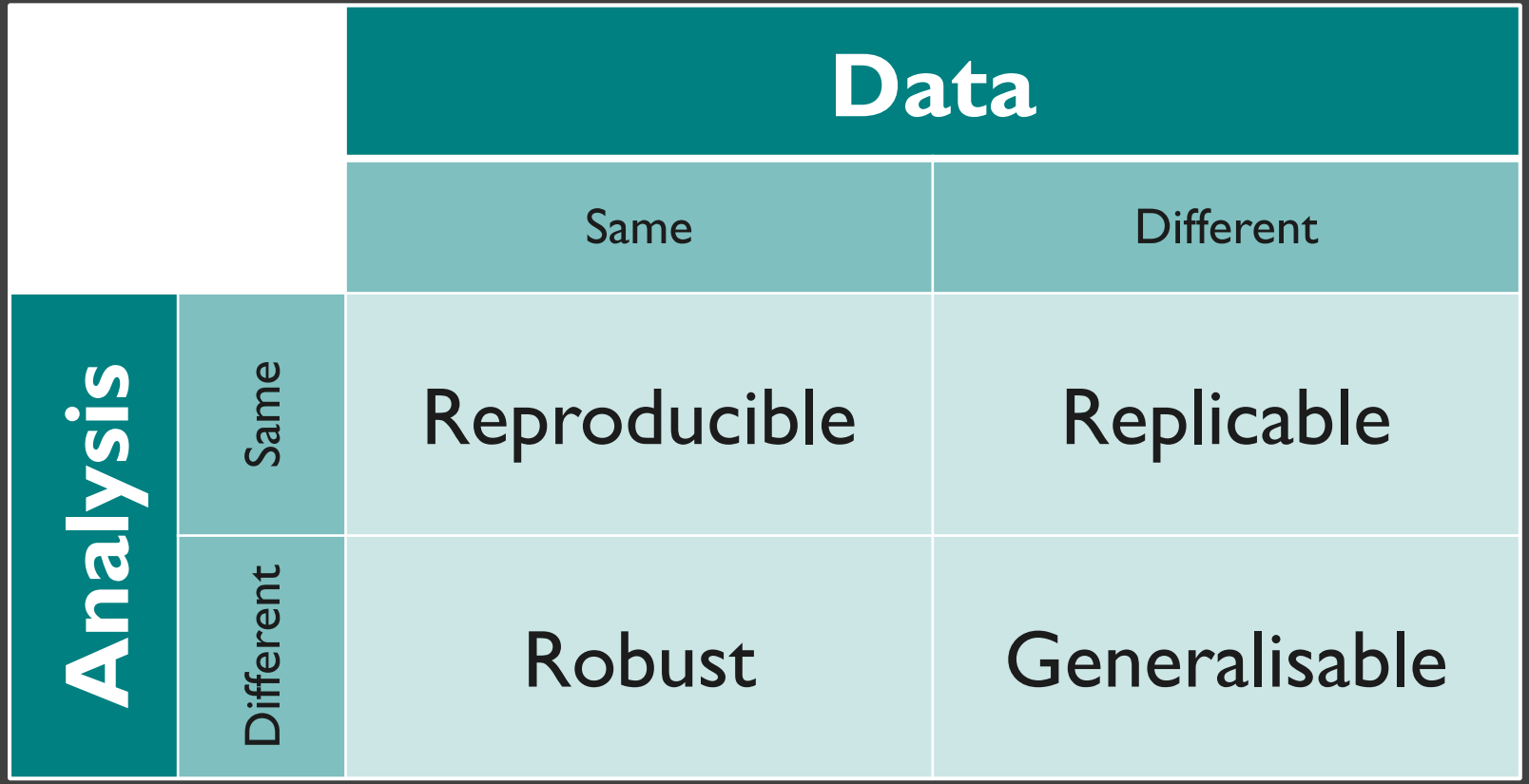
What is Reproducibility?





Kirstie Whitaker's talk at PyData LDN: https://youtu.be/IG3PcZ6EhiU

https://the-turing-way.netlify.com/reproducibility/03/definitions.html

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The science is the code

An article about computational science in a scientific publication is not the scholarship itself, it is merely advertising of the scholarship. The actual scholarship is the complete software development environment and the complete set of instructions which generated the figures.

Buckheit and Donoho
(paraphrasing John Claerbout)
WaveLab and Reproducible Research, 1995

Slide courtesy of Chris Holdraf and the Jupyter Team

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Upsetting take home message

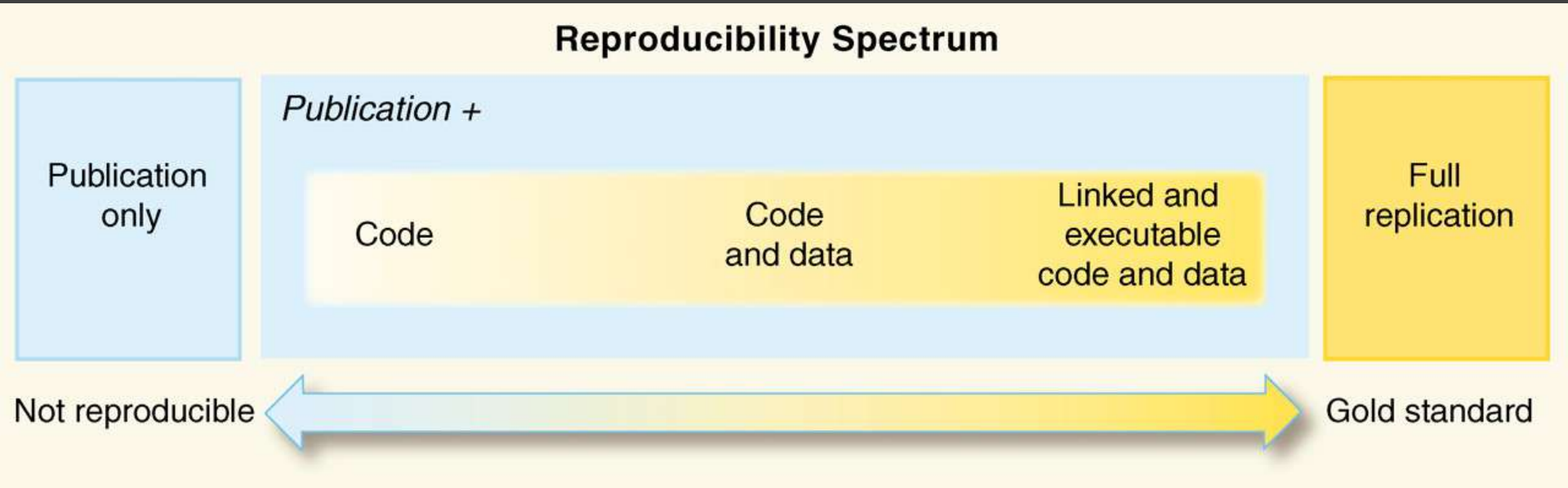
Sharing your code and data isn’t enough

The computational environment includes:

- Hardware (GPU, CPU)
- Operating system (mac, windows, linux)
- Software
  - Language version
  - Package version(s)

And all the interactions between the layers

You need the computational environment too



Peng, 2011, doi: 10.1126/science.1213847

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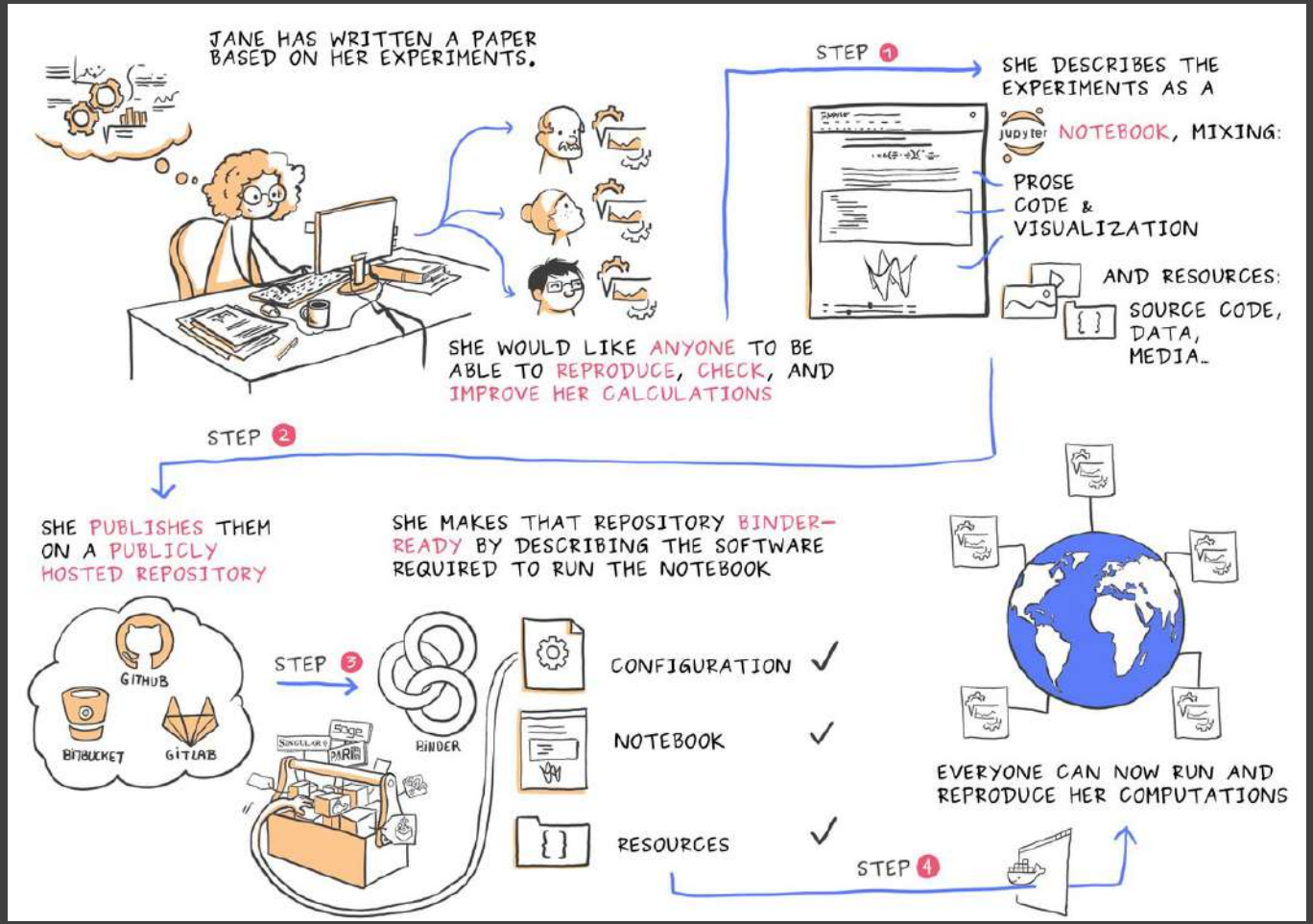
What is Binder?

– Project Binder is a global community

– Binder can host interactive code in a browser

– Project Binder is a global community

– mybinder.org allows launching interactive environments in a browser



binder

mybinder.org

Courtesy of Juliette Taka
https://twitter.com/mybinderteam/status/1082556317842264064

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binder-examples / requirements

Watch 3 | Star 15 | Fork 60

Code | Issues 0 | Pull requests 0 | Projects 0 | Wiki | Security | Insights

Branch: master ▾ requirements / requirements.txt

Find file | Copy path

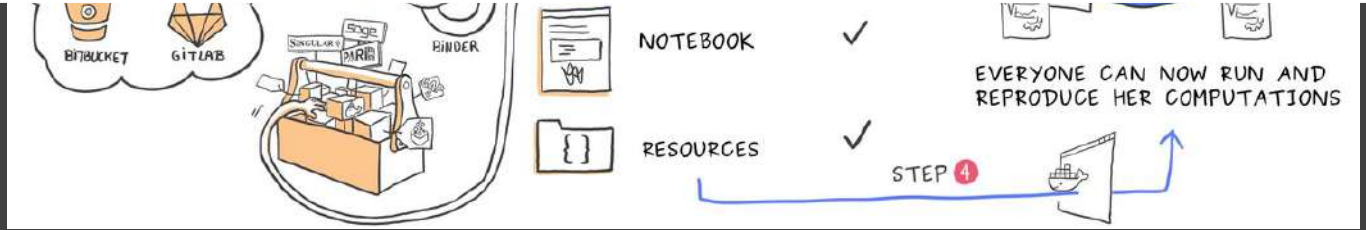
choldgraf Update requirements.txt 21a328d on 21 Jun

2 contributors

5 lines (3 sloc) | 46 Bytes

Raw | Blame | History

```
1  numpy==1.16.*
2  matplotlib==3.*
3  seaborn==0.8.1
4
```



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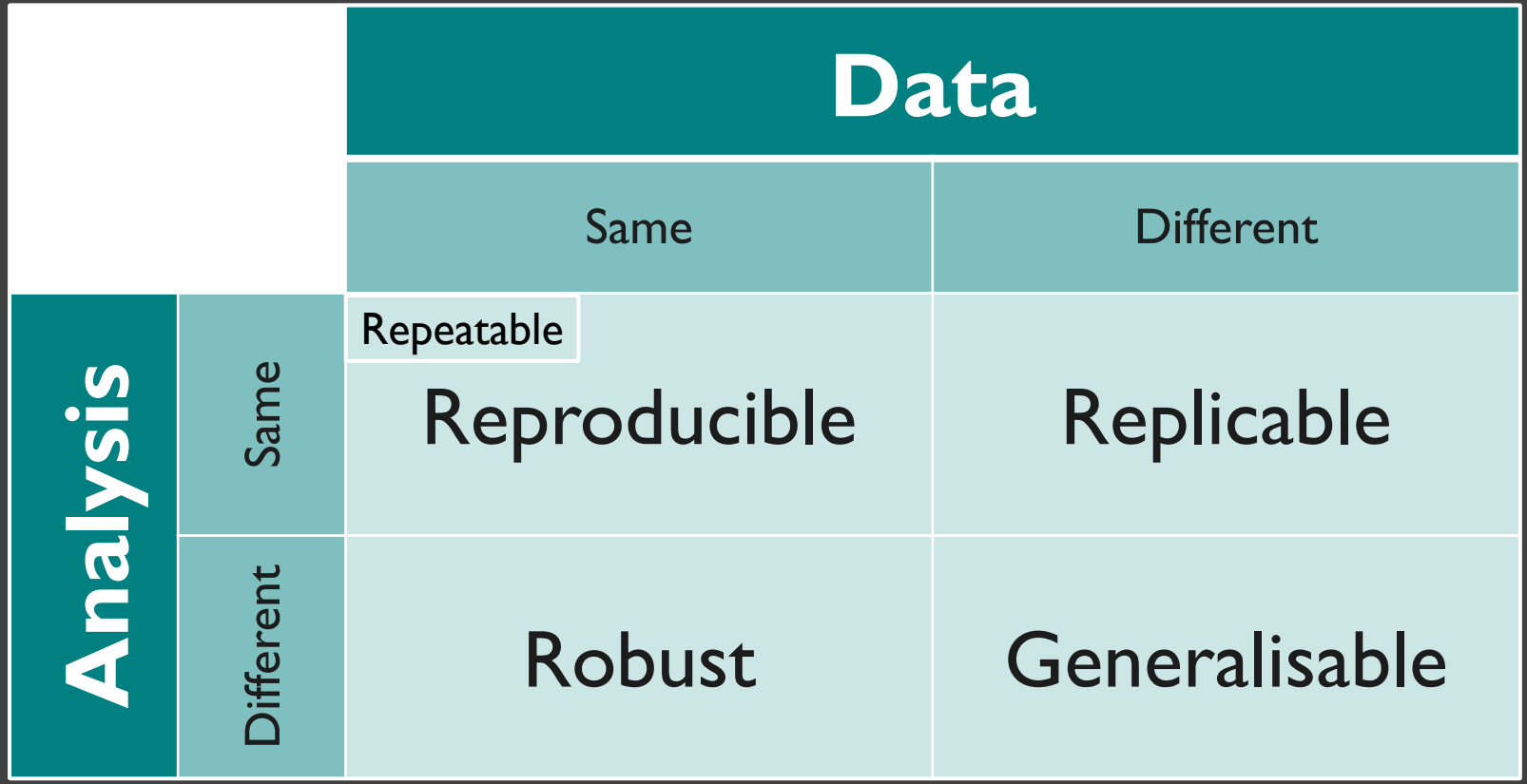

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Branch: master ▾ the-turing-way / workshops / boost-research-reproducibility-binder / workshop-presentations / zero-to-binder-python.md Go to file

...

 sgibson91 Tidy up the Python Binder tutorial ✓ Latest commit 808b9db on 3 Jun History

1 contributor

294 lines (197 sloc) | 13.9 KB Edit on HackMD Raw Blame

From Zero to Binder in Python!

Sarah Gibson, *The Alan Turing Institute*

The Turing Way - making reproducible Data Science "too easy not to do"

Based on Tim Head's *Zero-to-Binder* workshops which can be found here: http://bit.ly/zero-to-binder and http://bit.ly/zero-to-binder-rise

To follow these instructions on your own machine, follow this link: **http://bit.ly/zero-to-binder-python**

Binder can take a long time to load, but this doesn't necessarily mean that you Binder will fail to launch. You can always refresh the window if you see the "... is taking longer to load, hang tight!" message.

See HackMD for the link: https://hackmd.io/@malvikasharan/BinderJuly2020

Thanks to Google Cloud and OVH for sponsoring our computers 🎉!

Starting repository: jupyterhub/binder-billing/master

New to Binder? Check out the Binder Documentation for more information

Build logs show

Here's a non-interactive preview on nbviewer while we start a server for you. Your binder will open automatically when it is ready.

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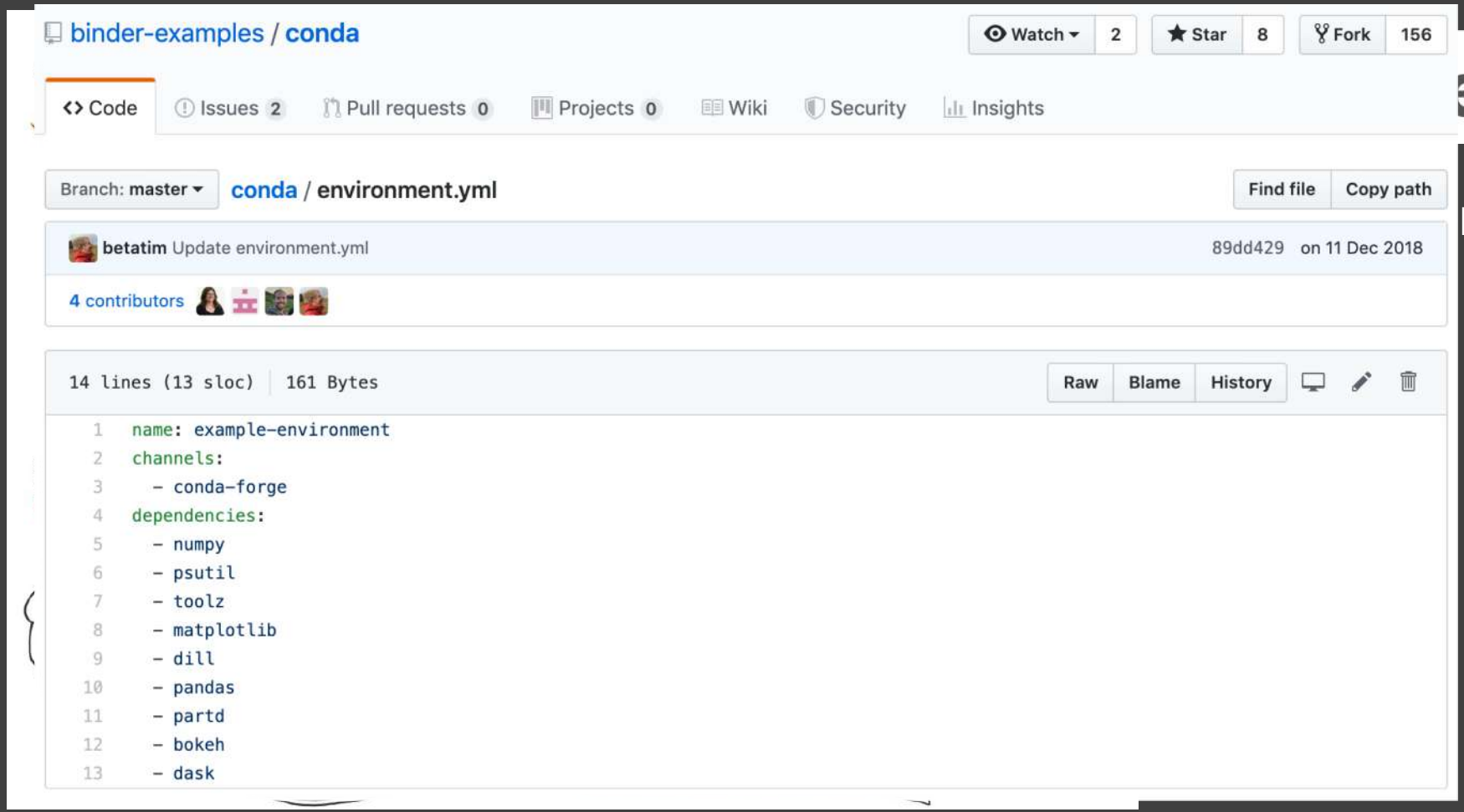

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binder-examples / binder-r-description

Watch 1 | Star 2 | Fork 1

Code | Issues 0 | Pull requests 0 | Projects 0 | Wiki | Security | Insights

Branch: master ▾ binder-r-description / DESCRIPTION

Find file | Copy path

gedankenstuecke first commit 70f8b8e on 18 Sep 2018

1 contributor

8 lines (7 sloc) | 282 Bytes

Raw | Blame | History

```
1  Package: binderdescription
2  Version: 0.1
3  Date: 2018-09-18
4  Title: Binder R DESCRIPTION support
5  Description: Test that automatically building R packages works
6  Author: Bastian Greshake Tzovaras <bgreshake@googlemail.com>
7  Maintainer: Bastian Greshake Tzovaras <bgreshake@googlemail.com>
```

Courtesy of Juliette Taka
https://twitter.com/mybinderteam/status/1082556317842264064

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binder-examples / r

Watch 13 | Star 71 | Fork 123

Code | Issues 3 | Pull requests 1 | Projects 0 | Wiki | Security | Insights

Branch: master ▾ r / install.R

Find file | Copy path

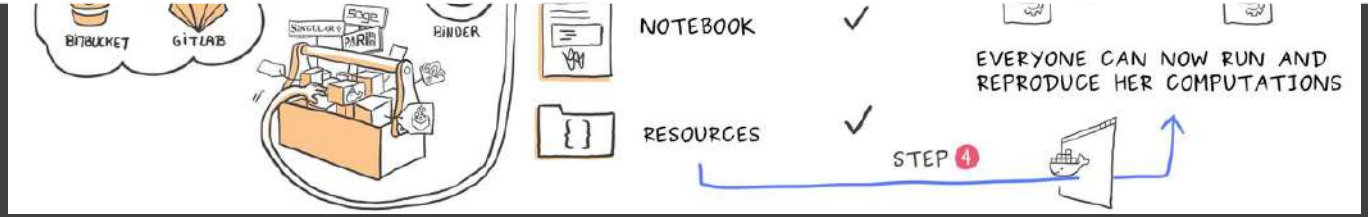
betatim Add example Shiny app — 8c01f0d on 31 May 2018

4 contributors

6 lines (5 sloc) | 148 Bytes

Raw | Blame | History

```
1  install.packages("tidyverse")
2  install.packages("rmarkdown")
3  install.packages("httr")
4  install.packages("shinydashboard")
5  install.packages('leaflet')
```



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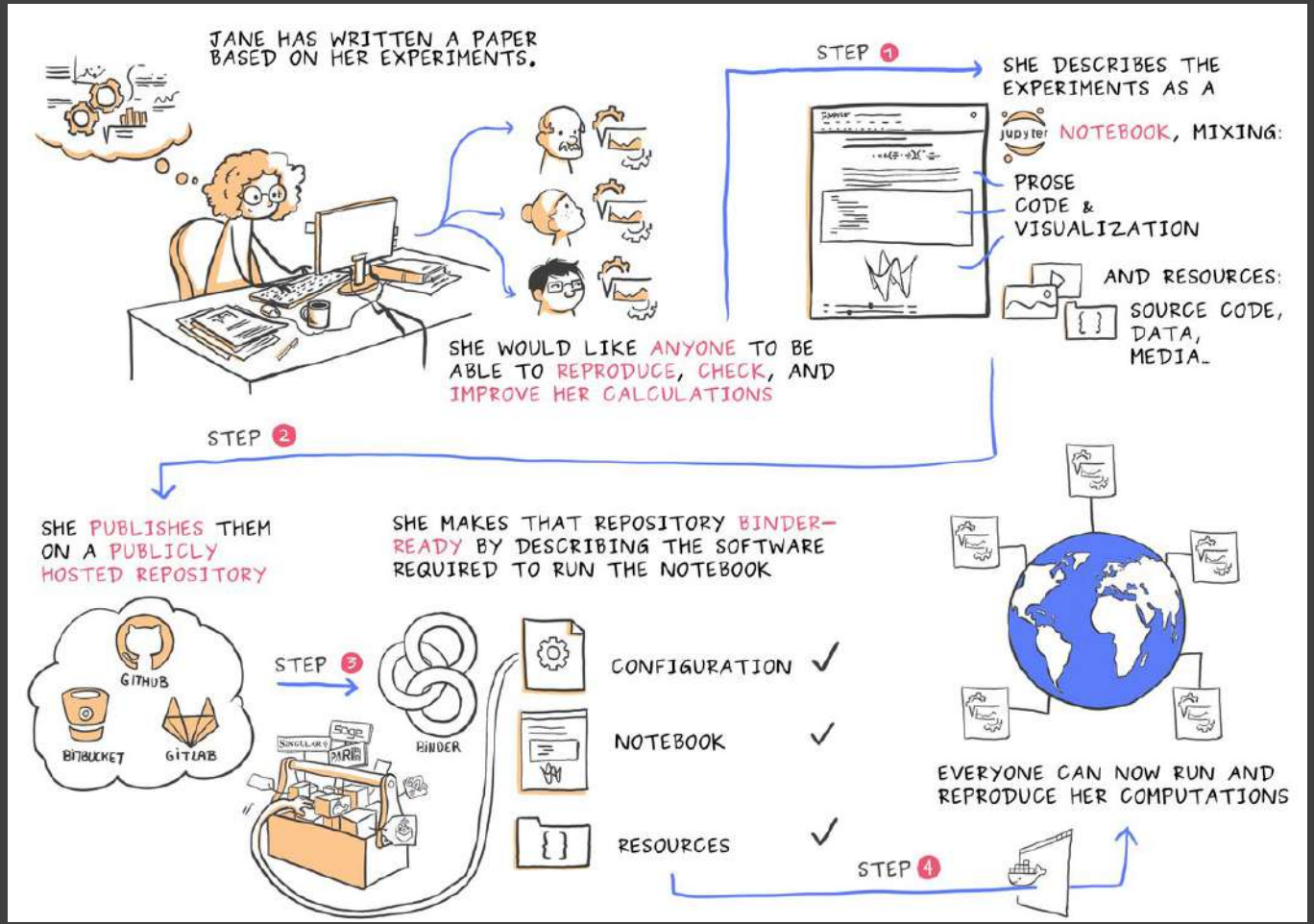

binder

mybinder.org

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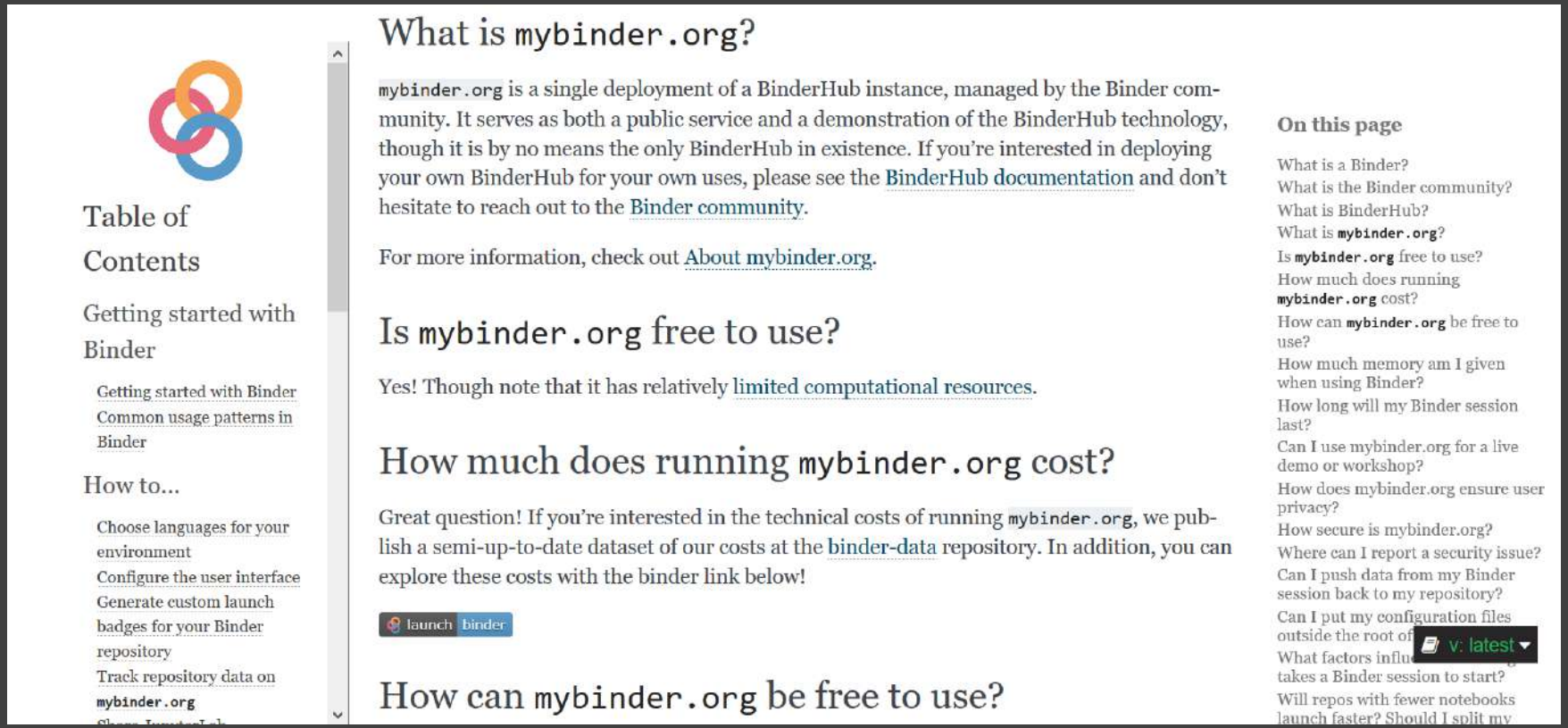
Sarah Gibson

“It took me a while to feel like I knew enough to contribute to Binder. But the team are always so excited to have my input. Its really motivating to be part of such a welcoming community.”

https://www.turing.ac.uk/people/researchers/sarah-gibson

@TuringWay, @drsarahlgibson, @mybinderteam, doi.org/10.5281/zenodo.3974919

- Check analysis on my phone
- Share the responsibility with busy PIs
- Requires version control, capturing environment and new build for each change



https://mybinder.readthedocs.io/en/latest/faq.html#how-much-does-running-mybinder-org-cost

Thank you!

Learn more about Binder:

- mybinder.readthedocs.io
- discourse.jupyter.org
- bit.ly/zero-to-binder-tutorial

The Alan Turing Institute

Learn more about reproducibility:

- Book: the-turing-way.netlify.com
- Twitter: twitter.com/turingway
- Newsletter: tinyletter.com/TuringWay
- Chat: gitter.im/alan-turing-institute/the-turing-way
- GitHub: github.com/alan-turing-institute/the-turing-way
- Original artwork by Scriberia: https://doi.org/10.5281/zenodo.3332808

Special mentions to these communities:

THE CARPENTRIES · mozilla · Open Life Science · Software Sustainability Institute · binder · netherlands eScience center